

## Covid-19's impact on Architecture, Urbanism and Health

Meriam Gaaloul<sup>1</sup>

<sup>1</sup> Faculty of Architecture La Cambre Horta - ULB (Belgique)

### Abstract

*This paper aims to assess the Covid-19's impact on Architecture, Urbanism and Health in the prevention and mitigation of pandemics and the place it may occupy in future international strategies. This paper examines how architecture can make communities and urban environments more resilient to disease and how healing design can support a global war on pandemics. This literature review paper aims to discuss the impacts and measures taken on Covid-19 with respect to architecture, built form and its allied fields along with observations from around the world with the end results of its implementation. Various research Internationals Journals from Science Direct and Taylor and Francis among others were referred and reviewed to learn more on Covid-19 along with its impacts on people and their built environment.*

*Keywords that aligned with the topic of interest like pandemic, Covid-19, coronavirus, urban spaces, built environment and built-up space were identified. Space, Structures, and Design in a Post-Pandemic World will influence anyone interested in how design thinking can transform how we see the world and those looking for new ways to understand what the COVID-19 pandemic means and what opportunities it creates for our environments.*

*The paper is a review article that seeks to provide a summary of recent writings that speculate on the possible futures of the post-COVID on architectural urbanism and health.*

**Key Words:** Architecture, Urbanism, Built Environment, Urban design, Health, COVID-19

### Impact du Covid-19 Sur L'Architecture, L'Urbanisme et la Santé

### Résumé

*Cet article vise à évaluer l'impact du COVID-19 en architecture : urbanisme et santé dans la prévention et l'atténuation des pandémies et la place qu'il pourrait occuper dans les futures stratégies internationales. Il examine comment l'architecture peut rendre les communautés et les environnements urbains plus résistants aux maladies et comment la conception curative peut soutenir une guerre mondiale contre les pandémies. Cet article de revue de la littérature vise à discuter des impacts et des mesures prises sur Covid-19 en ce qui concerne l'architecture, la forme bâtie et ses domaines connexes ainsi que des observations du monde entier avec les résultats finaux de sa mise en œuvre. Diverses revues internationales de recherche de Science Direct et Taylor et Francis, entre autres, ont été référées et examinées pour en savoir plus sur Covid-19 ainsi que ses impacts sur les personnes et leur environnement bâti.*

*Des mots clés correspondant au sujet d'intérêt comme pandémie, Covid-19, coronavirus, espaces urbains, environnement bâti et espace bâti ont été identifiés. L'espace, les structures et le design dans un monde post-pandémique influenceront tous ceux qui s'intéressent à la façon dont le design thinking peut transformer notre façon de voir le monde et ceux qui recherchent de nouvelles façons de comprendre ce que signifie la pandémie de COVID-19 et les opportunités qu'elle crée pour nos environnements.*

*L'article est un article de synthèse qui cherche à fournir un résumé des écrits récents qui spéculent sur les futurs possibles de l'après-COVID sur l'urbanisme architectural et la santé.*

**Mots Clés :** Architecture, Urbanisme, Environnement bâti, Design urbain, Santé, COVID-19

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<sup>1</sup> Corresponding author [meriam.gaaloul@ulb.ac.be](mailto:meriam.gaaloul@ulb.ac.be)

## INTRODUCTION

In late December 2019, an emergence (COVID-19) was first diagnosed in Wuhan, China, occurring due to a novel coronavirus [1]. The coronavirus has now been rapidly spread to almost all parts of the world [2,3]. The global outbreak of the novel coronavirus disease or COVID-19 has been declared as a pandemic like Ebola, Zika, and Nipah by the World Health Organization (WHO) on March 12, 2020 [2]. This is now considered to be of major international concern toward public health. The coronavirus disease (COVID-19) is triggered by 2019-nCoV or most commonly known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), belonging to the  $\beta$ -coronavirus cluster [4].

According to the report of the World Health Organization (WHO), the COVID-19 epidemic has already affected millions of people across the globe [3]. The data itself is alarming, and the entire humanity is battling this era's most gut-wrenching war. However, till date, in the absence of specific therapeutic drugs or clinically approved vaccines for COVID-19, intensive research is urgently needed on the newly emerged SARS-CoV-2 to identify potential drug targets and for the eradication of the pathogenic mechanisms and epidemiological characteristics for the development of effective strategies for its prevention and treatment [5].

This virus does not show consistent symptoms in all and spreads rapidly through contact with an infected person, so it is not easy to detect it without testing. Combating the disease is difficult as no specific therapeutics and with vaccinations arriving with slow lifting of restrictions. Hence, early detection and containment of infected individuals is the best possible approach to reduce the spread of the infection. Covid-19 has impacted every industry and eventually overall economy of every country. In order to contain and control the infection many countries and regions adopted lockdown policy by closing their borders and restricted day to day activities [6].

The COVID-19 pandemic has sent tremors around the world causing colossal loss to human lives, still bestowing an unprecedented encounter to public health, lifestyles and economies of the world which already stands gravely affected. Two years after the COVID-19 global pandemic, the worldwide lockdowns leave behind immense impact on millions of citizens, shutting down businesses and industries ceasing all the economic commotion. By February 2022, there have been 5.9 million official covid-19 deaths worldwide in the pandemic reported to WHO [7]. The covid-19 pandemic has re-centered health in our daily lives and reminded us that the places in which we live, work, play, and seek care all exert profound influences—intended and otherwise—on health outcomes. Yet, urban dwellers have long cohabitated with contagious illnesses, pollutants, and other environmental stressors, and, as a result, have attempted to create places that promote public and individual health in a holistic sense. These efforts can be read in built settings at all scales, from city plans and public parks to hospitals and homes. While there is much scholarly richness at the intersection of health and the built environment, this topic is somewhat marginalized in the field of urban and architectural history [8].

The novel coronavirus disease 2019 (COVID-19) pandemic has posed a major threat to human life and health. The COVID-19 had been documented in more than 210 countries, directly affecting people's life. There is a great crisis all over the world, and scientific communities are rigorously looking for instant solutions to deal with COVID-19 problems. The vital scientific communities are rigorously looking at these public health challenges, global crisis and finding new ways to deal with this pandemic disease. Currently, there is no specific effective approved drug or vaccine available in the market to treat or prevent COVID-19. Thus, there is an urgent need for more and better research to boost up the development. In the absence of health implications, the social and environmental counterreactions to the Modernist movement led to the Green Architecture, New Urbanism or Urban Village movements. After the last decades warnings about future pandemics, some of the present COVID-19 scientific findings have notable impact on the built environment design: pollution, green areas, urban population density or air quality control

As we crawl into the second decade of the twenty-first century, economy of several countries has hit rock bottom due to widespread of the pandemic "COVID-19". It is crucial to understand and comprehend that architecture is a powerful visual and objective tool that influences the economy of a region. Architecture is an excellent medium which reflects the economic condition of any area. Architecture is a manifestation of arts, technological advancement, socio-economic conditions, intention of builders and dynamics of above parameters of a place on time line.

Hence this research paper's objective is to unfold the impact of COVID-19 on architectural urbanism and health.

## HISTORICAL PANDEMICS COVID-19 AND ITS URBAN IMPLICATIONS

The name of this virus is derived from Latin word “corona,” which means “crown or wreath” [9]. This name “coronavirus” was first coined by June Almeida and David Tyrrell who first observed and studied human coronaviruses [10]. In an infected person, the viral spike protein in the virus attaches to host cell receptor, the virus particle is uncoated, and its genome enters the cell cytoplasm (Figure 1).

The family of coronavirus has been around us for a long time. Coronavirus was first identified in 1930, which was responsible for bronchitis in birds caused by infectious bronchitis virus [IBV] [11]. A decade later, in 1940s, two animal coronaviruses, mouse hepatitis virus (MHV) and transmissible gastroenteritis virus (TGEV), were isolated [12]. Researchers discovered evidence of human coronaviruses in the 1960. The virus B814s was isolated from the nose of a boy having common cold [13].

This isolated virus when inoculated into the nose of volunteers caused a cold and was inactivated by ether since it had a lipid envelope [13]. Meanwhile, another novel virus 229E was isolated, and like the virus B814, when inoculated in volunteers, it induced common cold and inactivated by ether [14]. Not only these two viruses were related to each other but were related to IBV also. The National Institutes of Health during the same time isolated another member of this new group of viruses, named OC43 [13]. All these viruses on electron microscope had distinctive club-like spikes [15]. This new group of viruses because of their distinctive morphological appearance is known as coronaviruses [12]. Since then, other human coronaviruses were discovered which include SARS-CoV (2003), HCoV NL63 (2004), HCoV HKU1 (2005), MERS-CoV (2012), and SARS-CoV-2 (2019) [17, 18].

COVID-19 is one amongst the many pandemics in recent history. Coronavirus isn't the world's first pandemic, there have been other pandemics that have hit the world and ended the lives of millions [19]; which not only affected the health field but also left urban impacts and economic consequences. Since the flu of 1918, at least eight pandemics with global social and economic effects have been documented [20]. Pandemics are part of the modern world. About 14 million people die annually because of a pandemic [21].

From the temporary breakdown of global supply chains to the hollowing out of once bustling city streets, COVID-19 has caused a seismic change in the way we navigate our urban environments. COVID-19 has been added to a long list of rapidly spreading infectious diseases in the current century, such as tuberculosis in South Africa in 2006, and Ebola in West Africa in 2014, which represents a new challenge for cities to plan effectively and to turn into healthy cities [22].

As history always reminds us of the interrelationship between critical diseases and features of cities, it could leave marks on our cities, our societies and ourselves, we should know that things will never go to be as it was the past. Although since the 19<sup>th</sup> century the built environment traditionally had a decisive role in mitigating pandemics, such as tuberculosis, the emancipation of medicine, after the discovery of antibiotics, gradually excluded architecture and urbanism from the strategies against pandemics.

In the context of COVID-19, there are relevant reasons for an interdisciplinary scientific approach of pandemics including the built environment and for a reevaluation of the future international strategies [23]. A pandemic is the worst scenario which happens when an epidemic outbreaks beyond the country's borders. When epidemics especially respiratory ones emerge, precautionary measures emphasize the necessity of isolation, and closure of public spaces. Also, it turns the image of cities and public spaces into empty environments, but mostly after the end of the crisis; it requires a change in the city's shape to integrate between community health practices and social thinking into urban design [24].

The COVID-19 pandemic acted as a catalyst to boost people's awareness and concern about climate change and environment. The reduced air pollution level and change in environment during COVID-19 shutdown/lockdown in different parts of the world gathered the attention of all and gave us time to introspect. As the health and human toll is still on rise, the economic impairment is clearly apparent and embodies the largest economic shudder the world has experienced in decades. Let alone the economic impact the pandemic has left both short- and long-term insinuations for mental health and lifestyles with thousand being unemployed and restricted to their homes.

The mental health impact of catastrophes can outlast the physical impact, several studies [25, 26, 27, 28, 29, 30, 31] point towards the need, and urgency of elevated mental health need will continue well beyond the COVID-19 pandemic itself. The daunting social wreck caused by the pandemic is equally devastating: With predictions

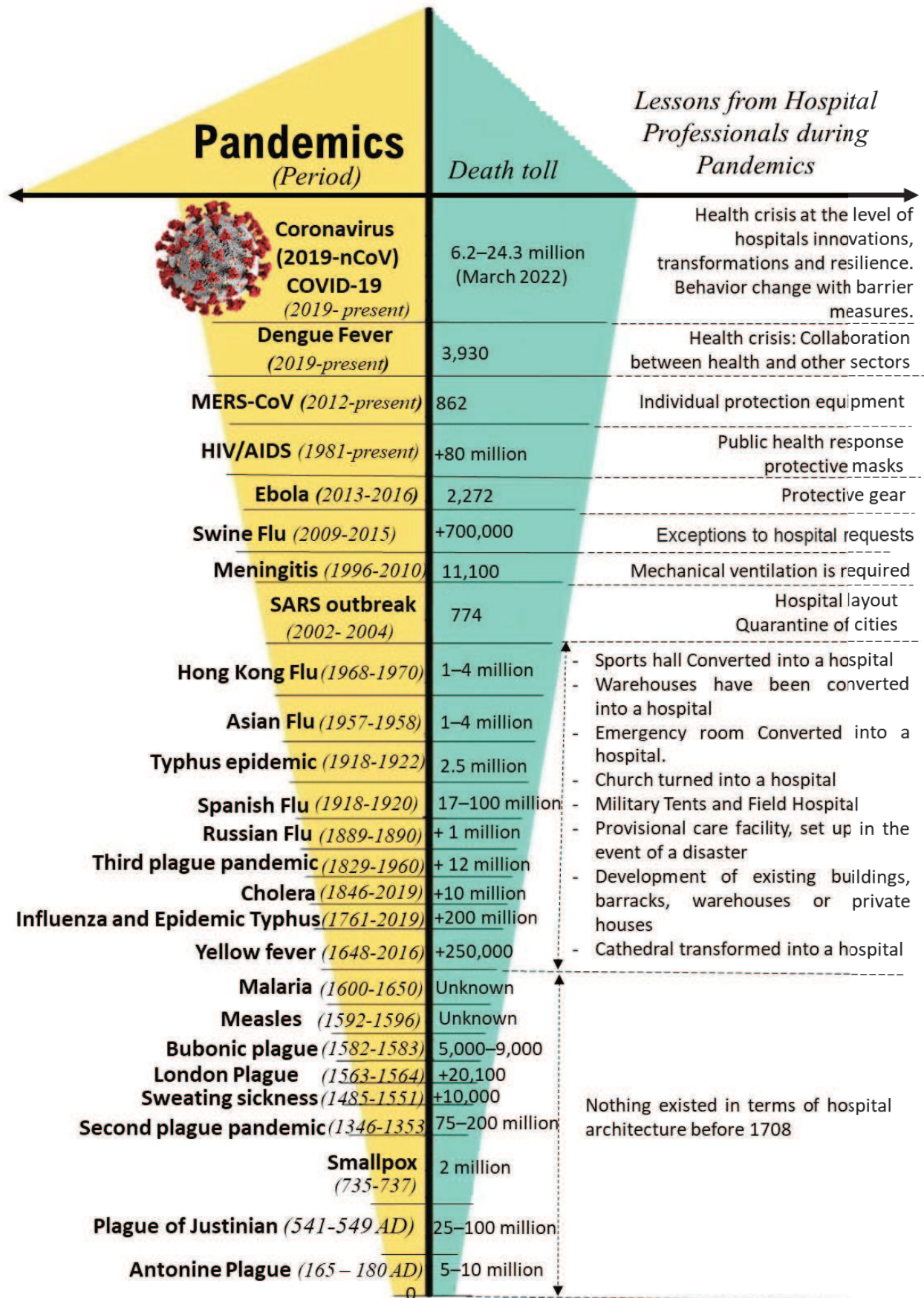


Figure 1. History of the deadliest pandemics, number of deaths and the lessons of hospital professionals during pandemics. (Statistical data was collected [https://en.wikipedia.org/wiki/List\\_of\\_epidemics](https://en.wikipedia.org/wiki/List_of_epidemics))

of tens of millions of people are at risk of dwindling into extreme poverty, up to 132 million being undernourished under the influence, which in turn possess a severe risk of increased mortality due to “deaths of despair”. The economic depression and social seclusion loom greater danger of drug and alcohol misuse with studies predicting greater fatalities due to suicides. The COVID-19 pandemic stands still as a major health and humanitarian crisis with profound impact on life, health and economy.

For the current emerging market and developing economies, with daunting vulnerabilities in the basket of uncertain future, it is critical to reinforce public health classifications and strong adherence steps against the spread along implementing reforms for stout and sustainable evolution once the health catastrophe subsides. In the race to alleviate the loads of the COVID-19 pandemic, it will be pretty vital to consider the augmented necessity for mental health services and to support pertaining the long-term loss and human impact even if the fatality and new infections dwindle. Over the longer prospect, the deep downturns prompted by the pandemic are anticipated to leave behind deep scars through significant attrition of human capital through lost labour, schooling and disintegration of global trade and supply connections all across the globe. It has been well-acknowledged that health and well-being have declined due to the coronavirus disease (COVID-19) pandemic in many countries worldwide [32, 33].

The COVID-19 pandemic and the related measures to prevent the spread of the disease have caused, among others, stress, anxiety, confusion, anger, depression, food insecurity, unemployment, and loss of economic activity [34, 35, 36, 37, 38, 39]. Cities and urban planning can contribute to health and well-being in a variety of ways [40, 41, 42, 43, 44, 45]. Recent research has started to explore the links between cities, urban planning, and COVID-19 ways [26, 42, 46, 47, 48]. However, as the pandemic is still an on-going phenomenon, the role of cities and their built environment characteristics in health and well-being during COVID-19 remains an open question that requires sufficient empirical documentation from a variety of urban environments.

The pandemic continues to evolve rapidly around the world. Disease progression remains uncertain, as emerging outbreaks and more infectious novel variants challenge the region's progress. Many governments took decisive actions early to contain the pandemic. Despite these actions, significant and persistent impact on both health and economic-related dimensions have been observed across many countries.

On the above, though the outbreak of COVID-19 may have somehow halted the attention on application of the smart cities concepts those different cities were piously pursuing, its management is seen to be prompting new legislations aimed at enhancing tech solutions to contain the spread, and most of these will survive postvirus. Their enactment, therefore, does not only address the virus, but in the future, they will also add to the existing ones on urban livability, and ultimately, they will lead to better urban and policy decisions. In particular, those policies have formulated to guide in restricting movements, instituting guidelines, and containing the transport sectors, and others will have a positive bearing in the future in ensuring issues such as traffic congestion, supply of basic services, and provision of securities and other issues are maintained. This will be based on the increasing data that different cities are generating those measures that have been placed to contain COVID-19.

With lockdowns, it has been evident that urban livelihood was to be negatively impacted, and in no time, this came to pass, with citizens in a number of cities in different countries protesting. This situation in cities is largely blamed on the haphazardly formulated policies that were mechanically enacted with little consideration of the negative impact that they would draw on locals. In most cities, despite the high population and density, government was seen to delay in implementing measures that would allow them to manage early detection, which would eventually help to reduce the number of local transmissions that prompted the lockdown. However, the blame is not all on government, for it also took time before it was established that the virus could be transmitted from one person to the other.

Therefore, in most cities, the lockdown came when local transmission had already spread. But while that is the case, local governments had the capacity to learn, especially by analyzing data of cities such as Wuhan, which was affected first, and see how cases were spreading quickly and thus prepare effectively, especially by formulating restrictions measures that are more flexible, while being effective, for locals.

The COVID-19 virus not only serves as a live case study for pandemic preparedness and response but also provides an opportunity to address the thematic of urban health.

## COVID-19 AND THE BUILT ENVIRONMENT

The “built environment” in healthcare refers to the hospital structure and any other fixed or semi-permanent components of the facility with which healthcare personnel, patients, and their families must interact [49]. The year 2020 came with the outbreak of COVID-19 and raised several questions before architects and urban planners regarding their role to make a more sustainable built environment in the post-pandemic world. This pandemic situation has not only impacted people’s daily habits and behavior but also challenged our cities, buildings, and interiors to evolve and sustain in the “New Normal World”. Given the infectious nature of COVID-19, the built environment can play a role in affecting transmissibility. Researchers, healthcare professionals, and healthcare architects and engineers have identified numerous areas of risk, offered mitigating solutions, and must now consider what modifications are necessary moving forward to continue to improve the safety of healthcare facilities, not just in response to COVID-19, but to foster resilience and capabilities for the next unknown threat to the healthcare system.

The role of architectural practice and pedagogy to respond, shape and rebuild a new normal consolidates the issues for living in a post COVID-19 urban century.

Several studies [50, 51, 52] suggest, that the adoption of inclusive design in design practice is limited so far, especially in relation to the built environment. This limited adoption may relate to misconceptions existing around inclusive design [53]. Heylighen et al., 2016 [50]. show Ten questions concerning inclusive design of the built environment that arise when inclusive design is considered in relation to the built environment. It discusses how inclusive design is defined and interpreted, what its relevance, implications and challenges are in relation to the built environment, how it relates to other significant design issues, and how it can be fostered in the future. As a result, many architects and other built environment professionals may feel uncertain as to what exactly inclusive design entails. This suggests that there are still many challenges to address, relating to the perceptions and the practical applicability of inclusive design.

On 19 December 2019, the global health crisis spread to every capital city, intermediate city and small-town. It forced governments, businesses, academics, professional and workers to invent new ways for all of society to function while controlling the spread of the disease and finding a vaccine. The ongoing task was, and is, to establish what has been called the new normal.

The professions, pedagogies and practices of architecture have identified the design problem and created new uses and designs of the spaces between buildings and the buildings themselves. While acknowledging the seriousness and magnitude of the problem the world faces, the papers in this special edition of the journal have generated an overwhelmingly constructive perspective on a new normal.

The accelerated adoption of online, digital and distance technologies has forced the disciplines of the built environment to tackle the technology/design/spatial experience triadic of architecture and urbanism in an immediate way, through pedagogy, practice, and research.

The interrelated impact and instant feedback of this adaptation in work/study, leisure and private life has created ways to embrace an uncertain future. The greatest lessons for business, government and citizens from a-normality have been demonstrated in new forms of co-operation between science, technology and society that has glimpsed a possible third way to a new and better normal.

As the healthcare community and healthcare architects look beyond the crisis response to the pandemic, the question becomes how COVID-19 – and what has been learned about infection control – will impact how the healthcare-built environment is approached in the future. Hospital EDs and other outpatient clinics may wish to consider more seamless integration of screening processes into facility entry points, creation of more permanent segregation of potentially contagious patients in waiting rooms, and perhaps also maintenance of reduced capacity to allow for more physical distance. In further support of physical distancing, both inpatient and outpatient facilities may need to consider whether they have adequate space available for the expansion of more permanent Health Insurance Portability and Accountability Act-compliant telehealth service offerings. Outside of the design elements, there is the opportunity to consider the incorporation of more sophisticated testing of the surrounding environment. This may involve implementation of more robust environmental risk management programs. For example, including regular testing of surfaces, water, and air for infectious contaminants.

## COVID-19'S IMPACT ON ARCHITECTURE AND DESIGN

Having only just two years of scientific knowledge with regard to the current pandemic, mainly on the health aspects and less on the wider effects or interrelations with the city environments, this paper attempts to contribute to filling the void in knowledge on how cities and built environment characteristics contributed to health and well-being during COVID-19. In early debates and research evidence, some built environment characteristics have been highlighted as fundamental for their potential contribution to health and well-being during COVID-19. These were urban density, public transport, access to facilities, green space, and housing.

*Urban density* has not only been widely debated for its contribution or non-contribution to virus transmission [44], but it has also been seen as a key feature during the pandemic as it influences, to a large extent, several other built environment characteristics. For example, denser urban areas can enable better, more frequent public transport services, easier access to facilities, while they are typically characterized by limited green space (especially in the form of private gardens) and by apartment blocks (and not e.g. detached housing) [55, 56]. Public transport, access to facilities, green space, and housing may contribute to health and well-being via different pathways [57, 58, 59] but these pathways or their importance seem to have changed during COVID-19.

*Public transport* might have been less safe to use during the COVID-19 pandemic because its enclosed space and the difficulty to maintain social distancing [60] and its use was reduced more than the use of other travel modes [60, 61, 62]. Residents who relied on public transport and who had to continue to travel (e.g. to work) during the pandemic might have experienced risk of infection but also stress and other negative feelings while traveling [63].

*Local facilities* (e.g. shops, education, recreation, healthcare) that remained open during the pandemic have allowed residents to participate in activities but also to have access to healthcare services when necessary [42, 47, 64]. Easy access to local facilities typical for mixed-use neighborhoods have also facilitated walking activity during the pandemic [65]. Therefore, via these different pathways, accessibility to local facilities could have contributed to health and well-being during COVID-19.

*Green space* (including both public and private green space) has been considered particularly important for mitigating the negative impacts of COVID-19 on health and well-being by offering emotional and mental health benefits and a safe open space for activity participation [66, 67, 68, 69, 70].

*The role of housing* has also been highlighted during COVID-19. Overcrowded dwellings may have contributed to more infections since social distances and quarantines are more difficult to maintain in tighter spaces [71]. Moreover, as people spent more time and performed more daily-life activities in their dwelling during the pandemic, larger dwellings were likely more functional and more pleasant contributing to better health and well-being outcomes [72].

The pandemic affected the design of built environments almost overnight as supermarkets erected plexiglass barriers, and grocery stores taped off areas to stand in line. Indeed, for stores, offices, restaurants, and other public spaces, Covid-19 “isn’t just a health crisis – it’s also a design problem.” Facilities have chosen to remove chairs from their waiting rooms, create separate waiting rooms for those displaying signs of COVID-19, and designate alternative waiting rooms and check-in processes outside of the facility to further minimize the number of patients inside a facility at any given time [73, 74]. Architects and designers have already observed several responses to this design problem, however, including:

*i) More automation (and fewer high-touch surfaces):* Many architects and designers predict an increased reliance on automated products and fewer shared surfaces, including touchless technology such as voice-activated doors and elevators, hotel room entry from mobile phones, or window/door blind and louver control from mobile applications or other remote controls. On a more low-tech level, the already-begun elimination of public restroom doors in many buildings will likely accelerate [75].

*ii) Healthcare design becomes everyday design:* As architects and designers create spaces with Covid-19 in mind, some design elements more standard in healthcare applications will likely play a more prominent role in our day-to-day built structures. This includes built-in hand sanitizing stations, improved ventilation and sunlight, a reduction of flat spaces that can catch germs, and the use of building materials that promote improved hygiene, such as antibacterial compounds and easy-to-clean products [76].

iii) *Rethinking of domestic spaces*: Having everyone working from home isn't so great if your home is so loud you can't concentrate, which is why there has also been a rethinking of domestic spaces with an emphasis on vision and sound control. "The loft, the New York City typology, seems to be not the romantic thing at the moment," notes Dutch architect Florian Idenburg. "Everyone's on Zoom calls." Similarly, the use of walls or room dividers on wheels have become in-demand as people stay home 24-7 and become bored with their space's layout [77].

iv) *An increase in modular construction and lightweight architecture*: The need to design and build quickly was thrown into stark relief during the pandemic's early days especially in healthcare when some hospitals had to convert private businesses or public spaces into makeshift field hospitals. This gave rise to a large demand in modular and prefabricated building materials and solutions designed with crisis response in mind [78].

v) *Reclaimed public spaces*: Outdoor dining in various public areas, once temporary, has now become a permanent fixture and that's only a small part of the transformation of public spaces in the wake of the pandemic. More people at home, along with fewer dining and entertainment options, means public spaces have taken on new importance and will see heavier investment and importance placed on them by cities [79].

A long-term reduction in office space demand is almost certain, as well, as organizations either go remote or rely more on hybrid models including remote teams combined with smaller office footprints. Some commercial leasing companies, as well, have offered solutions including:

- A fast yet thorough analysis of an organization's current space as it pertains to disease safety, with improvements made where necessary
- A set of virus mitigation rules, known by all who use the office, that prioritize safety above all else
- Visual, permanent routing markers and clear dividers for in-office traffic flows to ensure safety.

If COVID has shown us anything, it is that the ability to be all of these things supports creative responses to societal and political change and that robust creative efforts are essential to designing human survival in dangerous and unpredictable times.

As understanding of COVID-19 continues to evolve, the design of cities and buildings needs to be re-examined urgently to make them more resilient to future pandemics. A central element in the development of more responsive policies to the current pandemic, not to mention future crises, is the concept of urban "weak spots". While these frequently include the most economically disadvantaged areas of a city or region, the factors that determine their vulnerability are wide-ranging and can encompass a variety of dimensions relating to their location, connections, built environment and building design that leave them more exposed to shocks or stresses.

Cities should review local regulations to promote streets, sidewalks and plazas as public spaces and allow for more social, economic and cultural activities to take place, incorporating necessary requirements for social distancing and cleaning.

Individual spaces can be scaled up too many sites across a city, but cannot generally provide distribution, connectivity or locational accessibility. On the other hand, a citywide strategy can set clear spatial goals, governance arrangements, implementation plans and budgetary needs, in the process driving good urban development.

Strategize how to reconfigure existing building stock to adapt to new and emerging challenges brought on by COVID-19. Some of the most successful urban interventions in the first phase of the pandemic involved the imaginative repurposing of unused spaces such as hotels, stadiums and museums as health and care facilities when these were needed most. Even once the worst waves of the pandemic recede, there will still be considerable opportunities to reconfigure underutilized spaces as remote offices, educational facilities and other functions.

Cities should learn from their experiences during the current pandemic and develop an adaptive strategy in the event of further shocks. This could include identifying suitable multi-purpose buildings as part of health resilience plans to ensure equitable distribution and access to emergency buildings, especially for vulnerable populations in isolated or peripheral settlements.



## COVID-19'S IMPACT ON HEALTH

The COVID-19 pandemic has laid bare the risks that climate change, habitat destruction and our own consumer and travel behaviours pose not only to environmental health, but to public health as well. Animal species and zoonotic diseases that might have been contained to a specific locality in the past have proven, in today's globalized world, to leave no one untouched. Despite impressive gains in recent years, COVID-19 has exposed profound and longstanding inequalities within cities in access to safe drinking water and sanitation, as well as other essential services. During previous pandemics, such as Ebola in West Africa, lack of access to water and sanitation was a major determinant in which countries were worst affected [80]. With COVID-19, too, the absence of equitable water and sanitation services in many areas has left residents at heightened risk of contracting the virus. Well managed waste disposal is essential to public health, particularly in cities, yet more than 2 billion people are currently without basic waste management services. The number lacking access to controlled disposal of waste is even higher, at over 3 billion people [81]. The spread of the novel COVID-19 virus has caught the world by surprise, and as such, many uncertainties remain on the most effective solutions to apply in order to slow down the propagation of the virus. Authorities are making decisions about mitigation, confinement, isolation, quarantine, and health-care system capabilities. Individuals, depending on the country, culture, social-economic context, age, and season, are also making decisions concerning the pandemic. Similarly, current data points to adequate sanitation facilities as an important deterrent to COVID-19 transmission, as recent COVID-19 virus “sheds in faeces and can be detected in wastewater [82]. The situation is particularly alarming in low-income countries, where waste is frequently “dumped in watercourses or vacant land or burned in the open air near the residences”, [81] posing grave public health risks. Often, these polluting sites are located near marginalized neighbourhoods, further increasing the burden borne by residents of these areas. The pandemic has amplified the challenges of waste management. Increased use of plastic, disposable masks, protection kits, cleaning supplies, alcohol-based sanitizers, as well as the purchase and consumption of canned and packed food, has created many tonnes of additional waste, much of it hazardous.

Hospitals and healthcare facilities represent a class of infrastructure that can benefit from an adaptive approach to design. COVID-19 revealed that hospitals lacked the flexibility to easily pivot and scale-up to manage a pandemic surge [83]. Going forward, hospital administrators will need to consider how their spaces can expand and contract, depending on the number of patients who come in [84]. In addition to emergency beds, many hospitals will need to be able to adapt spaces for isolation units to handle infectious patients, and for anterooms for healthcare workers to safely don and doff their for personal protective equipment [84].

By the middle of the 19<sup>th</sup> century, the pavilion-style had emerged as the standard form of hospital design in the United States, and abroad [85]. A typical pavilion-style hospital was a low-rise (three to four stories tall) structure with U-shaped wards that extended out from a central corridor [86]. The design carved-out generous space between the wards for gardens, trees, and courtyards, connecting patients with nature. The height of the hospital was kept low in order to maximize wind flow and ventilation, and the wards were oriented to maximize daylighting [87]. Inside the wards, rows of beds were surrounded by windows to optimize light, views of nature, and cross-ventilation. Each design decision was intended to treat the hospital's architecture as part of the cure.

By the early 20<sup>th</sup> century, hospital design began to change. as new technologies and medical specializations emerged, the hospital building began to be regarded less as a “medical instrument,” and as more of a “facilitator for current medical behaviors and practices [88]. The advent of elevators and hvac systems also contributed to the change in the building's form, and how they are operated. for critics, this shift ushered in an abiding emphasis on efficiency, costs, and standardization, which came at the expense of patient healing [86].

In recent years, a growing body of research is confirming what the architects of the pavilion-style of hospitals knew from theory and intuition: that the built environment plays an important role in promoting health and well-being [86]. The research is being conducted in a number of fields from biology to psychology and building science. much of the research now falls under the banner of evidence-based design. in healthcare settings, this research shows that “the built environment impacts patient stress, patient and staff safety, staff effectiveness, and quality of care.” [89].

Despite what one may imagine, a virtual ward isn't about you having your clinical team at your bedside. Instead, the virtual model mimics a ward environment in an individual's home but with the clinical team at a distance. With a daily ward round for each patient, the ward clerk coordinates a patient's care from the office, with the clinical work being led by a matron. Back in those early days, the lowly telephone and home visits were the main

ways for the virtual team and the patient to keep in touch. It worked well, but before the pandemic had not been rolled out at scale. Fast forward to 2020 and COVID-19 created the perfect conditions to reinvigorate the concept of virtual wards. With hospitals straining at the seams, and fear of contagion making them feel a less safe place than before, being cared for at home had all the hallmarks of the perfect plan. Even better, advances in technology since the inception of virtual wards have turbocharged what was possible in the Croydon precursor to the contemporary COVID-19 virtual ward. This is how it works. Virtual pandemic wards enable patients to stay at home under supervision and for health professionals to spot early signs of deterioration which might require more intensive treatment. Sometimes the wards avoid the need for people to go into hospital and other times they enable early discharge from a hospital stay. As with many apparently digitally enabled innovations – pen, paper and telephone calls are often the default – but technology is starting to play more of a role.

## CONCLUSION

This paper outlines a series of risk factors that will increase the frequency and intensity of disease outbreaks in the years to come. As COVID-19 has shown, an outbreak can occur at any time. Architecture can be an agent to help reduce the risk. By creating spaces that prioritize health-giving attributes through the circulation of airflow, spatial design, biophilic elements, natural light, and selection of the right building materials architecture can be built for healing, and to support infection control. This review deals with the emergence and evolution of impact on Architecture, Urbanism and Health caused by the COVID-19 pandemic. It presents an overview of registered space-related manifestations within the different segments of urban environment, provoked by national, regional, or local regulations or voluntary recommendations applied in order to slow down the transmission of the virus, and the adaptation of urban residents to new circumstances. Both the introduced measures and the human adaptation that emerged in their response resulted in rethinking future Architecture, Urbanism and Health scenarios that provide resilience to new potential pandemics.

In the 19<sup>th</sup> century, cities like London, New York, and Paris implemented housing reforms to improve the living conditions in tenements and other dwellings. This period coincided with a broad sanitary movement to shape urban form to make it healthier. The incorporation of light, nature, and airflow into a building's design was seen as a prescription for sickness and disease.

In recent years, a growing body of research is confirming what the architects and planners from the past knew from theory and intuition: that the built environment can play an important role in promoting health and well-being. Studies show that the built environment affects cognition, productivity, and wellness in office spaces, and the quality of care in hospitals and healthcare settings.

COVID-19 has reaffirmed how the spaces we inhabit can either protect people or make them sick. COVID-19 has also shown how outbreaks of disease are spatial problems. As a field, architecture is well-suited to design spaces that reduce the public's exposure to contamination. With the right building materials, airflow, and spatial strategies, spaces can be designed to support infection control. The occasional occurrence of pandemics in the world is not unusual from a historical perspective. since time immemorial, humans have had to contend with these, but, fortunately, most of those remained local, especially due to a number of factors. first, the global population has been played a significant part in the spread of pandemics, and in earlier days, population were relatively smaller and people were sparsely distributed. secondly, the interaction between different groups of people from different countries and regions was limited as transportation infrastructures were not well developed, until recently. also, urbanization was not as pronounced as it is today, and this played a key role in preventing widespread.

In the post-covid-19 era, there will be an opportunity to prioritize health-giving attributes in the design and operation of the built environment. the fields of urban planning, architecture, and public health will have a key role to play in implementing, promoting, and monitoring healing design strategies and goals. The fields also have an important role to play in making communities more livable, healthy, and resilient. Solving this complex spatial problem with two equally emphasized and opposing focal points, however, will not be possible without clear manifestation of the impact of covid-19 crisis on the steady way of life in the city. as this impact has not been fully displayed yet, the long-term influence of the COVID-19 pandemic on city-shaping can at the present moment be considered at the level of speculation, and, indeed, the reviewed body of literature points to often conflicting views and visions of the post-COVID-19 urbanism and health. the exception is perationalized through several spatial themes on which the most authors have reached a consensus. these topics concern open urban spaces, residential and public building spaces, and urban contents.

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